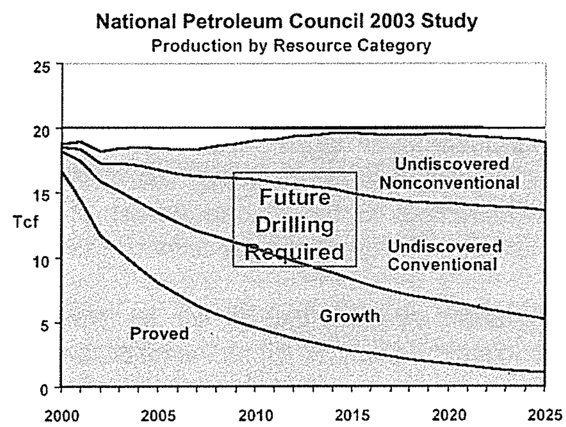
7. <u>To avoid the potential for lasting damage to the U.S. economy, therefore, there is a critical need to develop and immediately begin to implement on an urgent, "highest priority possible" basis a program to maximize development and utilization of domestic energy resources</u>.

   Any such program should have at least two major components:

   <u>First</u>, additional steps should be taken to maximize exploration and development of new natural gas fields. The National Petroleum Council concluded two years ago that, in order to maintain U.S. natural gas production at current levels, by as soon 6 or 7 years from now it would be necessary to obtain at least ½ of total U.S. natural gas production from wells in conventional and unconventional fields that, as of the time of the Council's Report in late 2003 had not yet been discovered:

<u>Figure 2</u>
<u>Expected Sources of Future</u>
<u>U.S. Natural Gas Production</u>



In recent years, however, the oil and gas industry has been more inclined to acquire reserves through M&A activities than by finding new gas in the ground with the drill bit --in part because Wall Street has tended to consistently under-priced the value of E&P assets.

As a result, the industry's development efforts have tended to be focused on in-field drilling and other steps to maximize production from existing fields.

This has allowed the industry to temporarily maintain production at a reasonable stable level – albeit only by increasing the number of new wells being drilled to very high levels and increasing the depletion rate of existing fields.

The inevitable effect of this strategy, however, is to accelerate the date when many of these fields are likely to enter a period of rapid and irreversible decline.

It is imperative, therefore, that a comprehensive program be developed immediately to encourage longer-term development projects that will expand the resources devoted to finding and developing new fields.

Such a program might include: (i) additional tax incentives or other measures to encourage exploratory drilling in unexplored fields; (ii) steps to accelerate training of additional geologist and engineers with the skills required for drilling and operating new wells; (iii) steps to accelerate construction of new rigs; (iv) measures to encourage Local Distribution Companies to enter into long-term natural gas supply contracts; and (v) funding and other measures required to accelerate the expansion of gathering systems into new fields.

Realistically, however, given the advanced stage of development of available natural gas reserves in the U.S., these measures are unlikely to result in a significant increase in U.S. natural gas production.

Instead, they will have achieved a major success if they avoid what otherwise is likely to be a steep further ***decline*** in available U.S. supplies from the lower 48 States and the Gulf of Mexico over the course of the next decade.

<u>Urgent need to develop and implement a major national program with a specific, defined scope, to deploy coal gasification</u>. As a practical matter, therefore, the only realistic strategy to avoid the potential for energy price shocks to cause serious harm to the U.S. economy, beginning in the near future and continuing for much of the next decade, is to develop and implement on an urgent, "highest priority possible" basis a major national program of specific defined scope to deploy coal gasification and build new Advanced Pulverized coal-fired plants for the specific purpose of preserving available supplies of natural gas for uses for which synthetic gas cannot be as readily substituted.

This is the only option available that: (i) can be implemented with certainty; (ii) from resources under direct U.S. control; (iii) on the required scale; (iii) and within the required time frame that is necessary to avoid becoming dependent upon the hope that it might be possible to massively increase imports of LNG as the near-exclusive strategy for meeting incremental U.S. natural gas and electricity requirements over the course of the next decade – with all of the potential costs and risks that such a strategy entails.

Any such program should include at least 3 major elements:

i. <u>Construction of coal gasification facilities to provide a source of fuel for this country's existing gas-fired combined cycle units (many of which are currently under-utilized)</u>.

The most critical need is to build coal gasification facilities to provide a new source of fuel for existing combined cycle plants.

Absent immediate action to build such facilities, in the near future, in many parts of the country, there are likely to be periods in which the available supplies of natural gas (including LNG) are not sufficient to simultaneously heat homes and office buildings, keep the lights on and continue to operate factories that use natural gas for feedstock and/or for fuel.

Building coal-gasification facilities to provide a source of fuel for existing combined cycle plants can potentially eliminate entirely the risk that we will be forced to make a choice between these competing uses.

Just as significantly, relying on synthetic gas from coal gasification units to substitute for a portion of the natural gas that otherwise would be consumed in powerplants will reduce total natural gas demand nationwide.

This in turn potentially will (i) reduce the cost of natural gas for all remaining users of natural gas; (ii) avoid increases that otherwise would be likely to occur in the wholesale price of electricity; and (iii) reduce the amount of LNG that it is necessary to import into the U.S.

ii. <u>Construction of coal gasification facilities at major industrial facilities that currently burn natural gas in order to reduce consumption of natural gas by such facilities</u>.

Installation of coal gasification capability at a significant number of large industrial facilities would be likely to simultaneously reduce industrial consumption of natural gas (and thus reduce overall upward pressure on the natural gas market) and enhance the ability of U.S. manufacturers to compete in global market.

In many instances, it may be possible to permit and construct such facilities with a lead time as short at 18 to 24 months.

iii. <u>Construction of new coal-fired plants to meet incremental electricity demand</u>.

Finally, the third critical component of any such program should be a plan to "fast track" permitting and construction of new coal-fired plants using gasification technology (or, where appropriate, Advanced Pulverized Coal plants) built for the specific purpose of minimizing the need to use natural gas for electric generation and reducing the potential need to rely upon imports of LNG.

The goal of the program just outlined (all three components combined) should be to add enough new coal gasification capability and new Advanced Pulverized Coal-fired capacity to displace at least 2.0 TCf to 2.75 TCf of natural gas consumption by 2015 and to displace an additional 2.0 TCf of natural gas consumption by 2020.

To accomplish this goal exclusively through the generation sector (which is not recommended) would required adding enough gasification capability (or, alternatively, in some instances, new coal-fired plants) between now and 2015 to either fuel 35,000 to 50,000 MW of existing gas-fired capacity operated at a high capacity factor or substitute for an equivalent amount of new capacity beyond capacity already being planned to meet organic growth. The equivalent of an additional 35,000 MW of capacity then would be required between 2015 and 2020.

The "all-in" cost for constructing all of the facilities necessary for such a program in all likelihood would be in the neighborhood of $ 75 to 100 billion.

The potential benefits, however, are staggering – both in absolute terms and compared to the alternatively of attempting to massively increase imports of LNG.

These benefits include the following:

- U.S. job creation. A high proportion of all of the capital expenditures and almost all of the subsequent property tax revenues associated with these expenditures would remain in the U.S. In addition, tens of thousands of permanent new jobs would be created to supply on an ongoing basis from U.S. sources of supply the fuel that otherwise will be obtained from overseas sources of supply.

  By contrast, while LNG projects are also highly capital intensive, 80 % or more of the investment in a typical LNG project resides overseas and almost all of the ongoing future revenues flow to other countries.

- Cost effectiveness. While no detailed study has yet been undertaken, at current fuel prices, these projects almost certainly would be cost effective by a very large margin; a payback on investment of hundreds of billions of dollars would be likely, a high proportion of which in all likelihood would be retained in the U.S.

- Avoiding prohibitive increases in U.S. natural gas and electricity prices. Just as significantly, by providing a realistic strategy for keeping total demand for natural gas in the U.S. more closely in line with available supplies, this program creates the potential to avoid what otherwise are likely to be prohibitive increases in the price of natural gas and electricity in the U.S. market.

  While these potential savings are difficult to estimate with any precision, given the potential for explosive further increases in natural gas prices if we continue going down a path of relying heavily on LNG to meet a high proportion of our incremental needs for natural gas and electricity, savings in natural gas costs in the range of anywhere between $ 1 to 4/MMBTU, compared to the prices increases that are virtually certain to occur if we rely on the alternative strategy of attempting to rely almost exclusively on increased imports of LNG for most of the next decade, are not the least bit unrealistic.

  In the existing 22 TCf per year market for natural gas in the U.S., this translates into potential savings that, by 2015, could easily reach $ 22 to 88 billion per year. Over the next 15 years, therefore, savings could easily amount to half of a trillion dollars or more.

  Further, since gas-fired generation increasingly sets the price for electricity in the wholesale market during many hours of the year, lower costs for natural gas are likely to result in direct, dollar-for-

dollar reductions in the wholesale price of electricity – which is four times as large a market.

Quite literally, therefore, in total, more than a trillion dollars in energy costs may be at stake over the next 15 years.

- Ability to retain U.S. manufacturing and farming jobs. Implementing this strategy also may be the only viable strategy for avoiding massive job loss in the manufacturing and agricultural sectors, where steeply rising energy costs are otherwise likely to make it nearly impossible for U.S. companies to continue competing effectively in the global market.

- Balance of payments benefits. From a balance of payments standpoint, the potential benefits are obvious – and potentially huge, both in terms of dollars spent on domestic sources of fuel, rather than imported LNG, and on the ability to retain jobs in key U.S. exporting industries, such as the chemical industry and agriculture (our two largest exporting industries).

- National security. Finally, from a national security standpoint, there also are clear advantages in relying upon domestic sources of supply under direct control by U.S. companies.

  It also is clearly preferable, from a national security and reliability standpoint, to obtain our energy supplies from diverse resources here at home than from a few, huge LNG "mega-projects," many of which may be located quite literally half way around the world (Qatar, for example, is located almost equal-distance from the East and West Coast of the U.S.), since the shutdown or destruction of even one of these mega-projects, or the capture by an unfriendly government, potentially could have a huge impact on the price of LNG in the global market, even if the U.S. does not purchase from the particular project that is shutdown (such, for example, projects that might be built in the future in Iran, Russia or Nigeria but then is subsequently shut down if the government of any of these countries decides at any point not to engage in overseas sales or not to sell to the U.S.).

In the energy sector, the U.S. has seldom been confronted with a set of choices as stark as the set of choices that confronts it now regarding how it will satisfy its incremental natural gas and electricity requirements over the next 10 to 15 years.

Regrettably, given the importance of the issues at stake, few choices have been subject to as little careful analysis.

As a result, the far-reaching potential adverse consequences of a heavily LNG-dependent strategy for the U.S. economy and the potential benefits of available alternative approaches are not yet well understood.

From the perspective of energy specialists, however, it is clear that whatever happens next, it is ***not*** going to be business as usual.

No one in the energy industry – literally on one – seriously contends that the natural gas requirements of the U.S. economy over the next decade can be met exclusively from North American sources of supply.

Indeed, we've already seen over the past 3 years that supplies are clearly insufficient to meet growing power sector demand.

The results have been painful:

Since the spring of 2002, natural gas prices have tripled. Wholesale electricity prices in the summer months have generally at least doubled and are likely to go up even more sharply this summer.

Further, at least 9 % of the industrial load that existed when the decade began has been forced out of the market – in many instances, forcing U.S. manufacturers to shut their doors or at least to ship manufacturing operations overseas.

Observers who have studied the natural gas market carefully, however, recognize that these dislocations are just the early stages of a more fundamental, longer term shift.

This is because underlying rate of demand for natural gas in the power sector is continuing to grow and our ability to expand production from domestic sources of supply has hit a brick wall.

Fundamentally, at least for the next 10 to 12 years, this leaves only two choices: to dive into the unknown, and to hope that we will be able to massively increase our imports of LNG, which we will need to obtain from projects that don't yet even exist and which ultimately may be priced on terms that are linked directly to oil or to engage in a measured strategy of increasing utilization of coal – i.e., the resource that has been our most dependable source of domestic energy for many years.

This choice can't be avoided for much longer.

This is because ***inaction simply puts us in an even deeper hole – potentially leaving us in a position in which in the very near future we have no alternative other than to buy LNG on the spot market at prohibitive prices (because it is too late to complete alternative coal-fired facilities in a timely manner) or be left with no source of energy (forcing U.S. manufacturers to permanently shut their doors).***

It is essential, therefore, that we begin to come to grips with the choices that confront us at the earliest possible date. Every day that passes without resolving this issue increases the likely harm to the U.S. economy and the likely loss of U.S. jobs.

The remainder of this paper will review more systematically the circumstances that led to our current natural gas supply crisis.

III. Factors that Led Up to the Current Natural Gas Supply Crisis.

A. Continued Importance of Reasonably Priced Electricity and Natural Gas to the U.S. Economy.

While higher oil prices have been in the headlines all year long, dependence upon imported oil is not the only or even necessarily the most important energy-related threat to the U.S. economy.

Instead, over the past several years, the U.S. has been experiencing even steeper increases in the price of natural gas -- increases that have begun to accelerate with increases in the price of oil. More recently, electricity prices also have begun to increase significantly, particularly at the wholesale level.

As shown in Table 1 below, direct use of natural gas and generation of electricity (in which natural gas is playing an increasingly important role), currently account for 56.3 % of total energy use in the U.S. – almost 1.5 X total use of oil:

Table 1
Total U.S. Energy Use – 2004
(Quad BTU)

Use	Consumption	Percentage of Total U.S. Use
Generation of Electricity	38.86 Quad Btu (Incl. Use of 5.33 Quad Btu of Natural Gas and 1.20 Quad Btu of Oil)	38.9 %
Direct Use of Natural Gas by Residential, Commercial & Industrial Users	17.40 Quad Btu	17.4 %
Direct Use of Oil (Including Transportation)	38.86 Quad Btu (Incl. 2.85 Quad Btu of Natural Gas Liquids)	38.9 %
Direct Use of Coal & Other Fuels	4.69 Quad Btu	4.7 %
Total U.S.	**99.81 Quad Btu**	**100.0 %**

Source: Energy Information Agency (EIA), Annual Energy Outlook 2005, Supplemental Table 10

Providing affordable and reliable electricity and natural gas is critical, therefore, to the continued health of the U.S. economy.

If only the price of oil increases rapidly, to a substantial degree the damage potentially can be confined. A $ 15 per barrel increase in the price of oil, for example, takes $ 120 billion a year of purchasing power out of the economy. This is a significant blow, but is not necessarily likely to cause a recession.

Further, since the primary impact of an increase in oil prices is to increase gasoline prices, an increase in the price of oil of this magnitude will not necessarily have a significant adverse impact on the ability of U.S. manufacturers to compete in world markets.

If a similar increase in energy prices extends to all three major forms of U.S. energy consumption, however – including natural gas and electricity – the potential adverse impact on the U.S. economy is likely to be significantly greater. In the example just given, for instance, the reduction in purchasing power is likely to be 2.5 X as great – i.e., potentially $ 300 billion, rather than $ 120 billion. The resulting adverse impact on the U.S. economy, therefore, is certain to be much greater.

In addition, a significantly larger share of the impact of increases in the price of electricity and natural gas is likely to be borne by manufacturer, since they account for a significantly higher percentage of total consumption of both forms of energy.

This inevitably increases the risk that the ability of U.S. business to compete in global markets will be significantly impaired.

Fundamentally, the bottom line is clear: the U.S. economy can not grow without increased supplies of electricity and natural gas. Further, since most remaining use of natural gas and electricity are essential to public safety and welfare, in the event of shortages, the manufacturing sector is likely to be the first to be curtailed.

While increased oil prices pose a serious threat to the economy, therefore, to maintain the health of the U.S. economy, it is at least as critical to provide adequate supplies of electricity and natural gas and to keep prices within acceptable limits.

Our continued ability to do so, however, is uncertain at best.

America's Competitive Advantage

The potential importance of natural gas and electricity prices to the economy is underscored by the fact that, during most of the past 30 years, one of the major competitive advantages enjoyed by U.S. manufacturers has been access to reliable and affordable electricity and natural gas.

America's two largest exporting industries, for example, are its chemical industry and the farming industry.

Historically, the competitive strength of both of these industries has been based in part on access to reasonably priced natural gas or (in the case of agricultural) fertilizer (which is produced primarily from natural gas).

The chemical industry (which is the largest user of natural gas in the economy) uses natural gas for both feedstock and fuel, converting it into a wide range of products -- historically ranging from plastic bags to fertilizer to pharmaceutical products; the farming industry in turn relies heavily on fertilizer as one the primary inputs into the cost of production of many crops.

For both industries, for many years the availability of reasonably-priced natural gas in the U.S. market was a major factor allowing these industries to compete successfully in global world markets.

Until the past 24 to 36 months, these two industries in turn ordinarily were able to generate a large balance of payments surplus, which helped to offset deficits in other sectors. The net trade surplus enjoyed by the U.S. in chemical products, however, has fallen dramatically over the past few years. The U.S. also is now expected to become a net importer of agricultural goods in some months this year.

While these industries may never fully regain their former status, the continued ability of both industries to compete in global markets (as well as the continued competitive strength of much of the remaining manufacturing base in this country) is likely to be closely tied to the continued availability in the U.S. market of adequate supplies of electricity and natural gas at competitive prices.

B. Factors Driving Prices Increases for Electricity and Natural Gas.

With this issue in mind, it may be helpful to examine in more detail: (i) why natural gas and electricity prices remained reasonable for many years; (ii) why prices have begun to increase rapidly in recent years; and (iii) the steps required to ensure the continued availability of sufficient natural gas and electricity to enable the U.S. economy to continue growing at a normal rate.

1. Reasons Why Natural Gas Remained Competitively Priced for Many Years.

Until just a few years ago, many believed that natural gas prices were likely to remain low indefinitely – i.e., that ample supplies and attractive prices were somehow foreordained. This belief existed in large part because natural gas supplies had remained adequate and prices unusually stable for a period of more than 20 years, starting in the late 1970's and continuing through 1999.

The availability of adequate supplies of natural gas at attractive prices for more than two decades, however, was due primarily to three specific factors – none of which is destined to continue:

- Decline in use of natural gas due to restrictions on use. Natural gas use initially rose sharply in the U.S. in the late 1960's and early 1970's, leading to prices spikes and temporary shortages.

  In response, in the mid-1970's Congress banned the use of natural gas in new powerplants and imposed certain other restrictions on the use of natural gas. Some states also temporarily barred Local Distribution Companies (LDC's) from adding new customers.

  As a result, after peaking in 1973, natural gas use declined for many years, bottoming out in 1986 at a level more than 26 % below the 1973 peak. Total U.S. consumption did not return to earlier highs until the late 1990's; not many years thereafter, prices once again began to increase.

- Initial surge in production due to de-regulation of the wellhead price of natural gas. At the same time that Congress imposed temporarily restrictions on natural gas use, it also began to de-regulate the wellhead price of natural gas.

  For a number of years, this proved to be an effective means of spurring increased production. It is unclear, however, whether it increased significantly the amount of gas ultimately recovered from any one field.

By encouraging greater efficiency, de-regulation undoubtedly helped to accelerate reductions in finding and development costs, improving profit margins. It also tended to encourage greater drilling.

The primary effect of the efficiency improvements, however, was to increase the speed and efficiency with which oil was extracted from reserves in existing fields. This has had the effect of moving closer in time the date when production from many major U.S. fields began to rapidly decline, *reducing* the supplies that remain available from these fields.

- Availability of attractive new targets for development close to home. Finally, while natural gas production from conventional on-shore wells in the thee largest U.S. producing states (i.e., Texas, Louisiana and Oklahoma) peaked in the 1970's and by the mid-1980's already had declined significantly, throughout the 1980's and 1990's, there still were attractive targets available for development either on or immediately off the North American continent to offset the production lost from these fields. These areas included the so-called "Near-Shelf" Region in the Gulf of Mexico (the shallow waters, less than 600 feet in depth, immediately often the Gulf Coast) and Alberta in western Canada.

  For many years, increases in production from these Regions (which were just beginning to be developed in the 1970's and still contained large pockets of natural gas that could be developed at relatively low cost) largely offset the declines in production that were occurring from conventional wells in more mature fields in Texas and other states.

  By the late 1990's, however, the Near-Shelf Region was beginning to enter a period of rapid decline. Soon thereafter, production in western Canada began to plateau.

  Until the situation 20 years earlier, no longer was a new set of opportunities close at hand to replace the lost production from these fields once they began to decline. Instead, after 30 + years of development, most major fields in the U.S. and Canada were beginning to reach an advanced stage of maturity.

  To obtain additional supplies, therefore, it became necessary to either attempt to develop significantly smaller targets (which requires drilling a much greater number of wells with much shorter average life spans) or to attempt to more distant and/or more difficult to develop sources of supply (e.g., Deepwater projects increasingly far out in the Gulf of Mexico or projects in the Arctic Circle in Canada).

  The Deepwater projects, however, tended to be far riskier and more capital intensive, with lead times of up to 4 to 5 year. As a result, developers typically were considerably more cautious in deciding whether to go forward with these projects.

2. Early Indications that Changes Might Begin to Occur.

By the late 1990's, the number of attractive, conventional on-shore targets for development in both the U.S. and Canada was beginning to decline rapidly. The targets that remained tended to be smaller and/or deeper or more costly to develop every year.

Even during this period, however, the wellhead price of natural gas generally remained stable, due principally to two factors:

- During the period between 1996 and 1999, there was essentially *zero* increase in total U.S. demand (more on the reasons for this in a moment);

- Any declines in U.S. production that occurred during the late 1990's were more than offset by continuing year-over-year increases in imports from Canada.

This helped to perpetuate the false impression even on the part of many within the energy industry that natural gas prices were destined to remain low indefinitely. (Note that, by the late 1990's generally had traded within a narrow range for almost 20 years in nominal dollars and had declined in real terms. At least at first blush, therefore, there appeared to be every reason to assume this trend would continue for many years.)

Beneath the surface, however, profound changes were beginning to occur -- both on the demand side and the supply side. This simultaneous shift (i.e., a sudden increase in demand, just as supply was about to abruptly decline) in turn set the stage for the natural gas supply crisis we face today.

Abrupt Shift In Power-Sector Consumption of Natural Gas

For many years, during most of the 1980's and the early 1990's, power sector consumption of natural gas generally had been relatively flat.

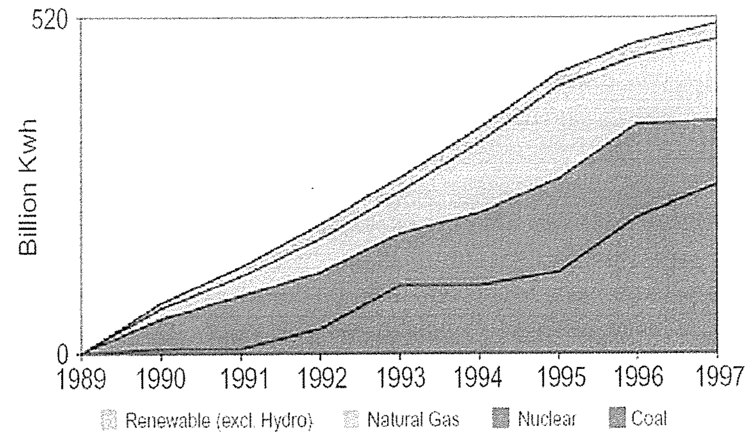
This is largely because, even though demand for electricity typically grows every year (the only exception generally is when there is a major recession), until the late the 1990's, the utility industry still had a great deal of excess coal-fired generating capacity. This excess capacity was left over from the oil price shocks of the 1970s.

In addition, during the 1990's, as the utility industry began to move towards a competitive model, generators learned to operate existing coal and nuclear plants more efficiently, generating far more hours from existing plants.

As a result, even during the 1989 through 1997 time frame (i.e., almost two decades after the oil price shocks of the 1970's), generators were able to meet more than 3/4th's of the growth in demand for electricity that occurred during this period by generating more electricity from existing coal and nuclear plants (shown in brown and dark blue in Figure 3 below):

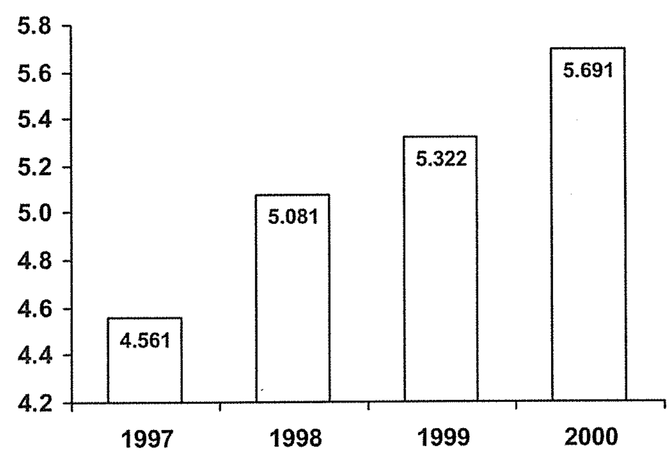
Figure 3

Source of Electric Generation to Meet Incremental Demand (1989-97)



By 1998, however, this began to change and power sector consumption of natural gas began to significantly increase:

Figure 4
Increases in Power Sector Consumption of Natural Gas
1998 - 2000



This increase, however, was not generally recognized at the time, for two reasons:

- Due to a quirk in EIA's reporting system, during the late 1990's these increases were reported as increases in industrial consumption of natural gas. (The data used in preparing Figure 4 above was obtained from subsequent EIA Reports, which revised the figures that EIA had reported during the late 1990's.)

- In both 1998 and 1999, the U.S. experienced unusually mild winters, reducing the use of natural gas for space heating. As a result, there was a drop in space heating demand that offset almost exactly the huge increase that was occurring in power sector consumption of natural gas in these years. As a result, in both years, total U.S. demand for natural gas was virtually unchanged from 1995 – 1997 levels.

Due to the 2nd of these quirks (i.e., mild weather that offset almost exactly the increase in power sector consumption of natural gas that occurred 1998 and 1999), the price of natural gas continued to remain moderate in 1998 and 1999 despite an unprecedented 760 BCf increase in power sector consumption of natural gas between 1997 and 1999. This provided further reinforcement for the mistaken belief that natural gas prices in the $ 2.00/MMBTU range were likely to persist indefinitely.

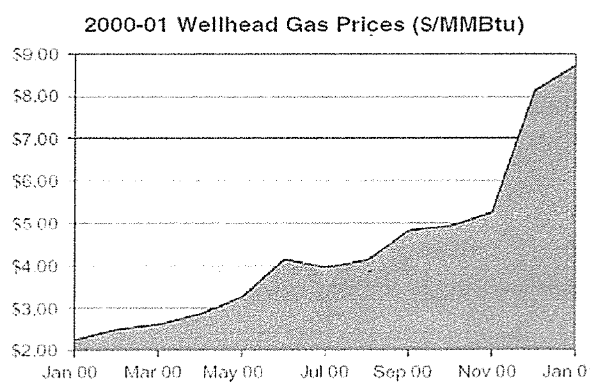
In 2000, however, two changes occurred:

- First, as shown in Figure 4 above, in 2000 there was a third consecutive year of significant year-over-year growth in power sector consumption of natural gas. The increase in power sector consumption of natural gas that occurred in 2000 was not any greater than in the previous two years; instead, it was slightly smaller than the average increase during the previous two years. But it added to the total growth that had occurred since 1997.

- Second, for the first time since power sector consumption of natural gas began to increase significantly in 1998, this growth no longer was masked by warm weather in the winter. Instead, to the contrary, temperatures early in the winter were significantly colder-than-normal.

The combined impact of these two factors, quite literally was explosive: during the last 8 months of the year, due to these two factors – and these two factors only – natural gas prices nationally quadrupled in a year in which no one in the industry had predicted a major increase in the price of natural gas:

Figure 5
Increases In Wellhead Price of Natural Gas During 2000



Notably, this quadrupling in natural gas prices occurred in a year in which newly-delivered supplies available to the U.S. market set ***an all-time record***, due to a combination of near-record U.S. production + record imports from Canada.

The unprecedented run-up in natural gas prices that occurred in 2000 resulted in more than $ 50 billion in increased costs for natural gas and electricity nationwide – may have been a significant contributing factor helping to bring about the severe U.S. manufacturing recession that began the next spring.

In addition, several studies have concluded that it was one of the two primary causes of the California energy crisis (the other was a shortage of generating capacity) – which occurred during the same time period as the run-up in natural gas prices nationally and resulted in more than $ 14 billion in unanticipated power supply acquisition costs.

<u>Early Indication of Crisis to Come</u>. While not properly understood at the time, the run-up in natural gas prices late in 2000 and early 2001 was an early indication of a much deeper crisis to follow.

Immediately after the 2000-2001 price spike occurred, however, the deeper changes which caused this price run-up to occur were once again masked -- this time by the confluence of four major factors:

- An abysmal failure of data analysis and interpretation. In part due to the quirks that existed at the time in the EIA data, the underlying causes of the 2000-2001 run-up were not understood at the time they occurred. Indeed, to this day, the role of increased power sector consumption of natural gas in bringing about the quadrupling of natural gas prices in 2000, the subsequent harm to American manufacturers and the U.S. balance of payments and the California energy crisis of 2000 is not well understood even within the energy industry;

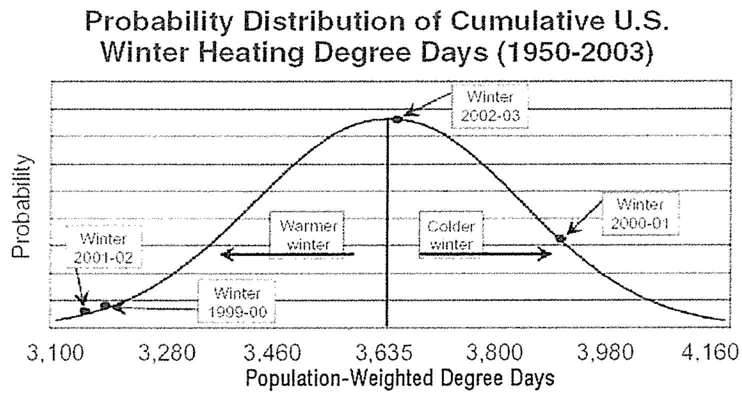
- The worst U.S. manufacturing recession in 22 years, which began in the spring of 2001 and may well have resulted in part from the run-up in natural gas prices that preceded it. This severe manufacturing recession had the effect of significantly reducing industrial and power sector demand for natural gas (since electricity demand contracted along with the economy), reducing the pressure on the natural gas market;

- Extraordinarily mild weather, especially in the fall of 2001 and the winter of 2001-2002, which was close to a "once in a 100-year type winter." This once again, just as is 1998 and 1999, produced a huge reduction in the use of natural gas for space heating compared to normal levels that masked the underlying increases in power sector consumption of natural gas; and

- The September 11th attacks, which caused the recovery in the U.S. manufacturing sector to temporarily pause, just as the U.S. economy was starting to rebound.

The mild weather that occurred in the winter of 2001-2002 was a particularly significant factor that completely offset the impact of the build-up in power sector consumption of natural gas that had occurred over the previous three years. Both then – and now – however, few in the energy industry were aware of just how significantly the weather that winter (and previously in the winter of 1999-2000) had deviated from historical norms:

Figure 6
Winter of 2001-02 vs. Historical Norms



Conditions were ripe, however, for natural gas prices to once again explode as soon as winter temperatures returned to more normal levels – just as they did the following winter, in the winter of 2002-2003.

3. The Decision to Build a Massive Number of New Gas-Fired Power Plants.

The likelihood that winter-weather would return to more normal levels, however, is not the only reason or even necessarily the most important reason to expect that natural gas prices will begin to increase again as we moved further into this decade.

By the late 1990's, the surplus generating capacity that had existed in most Regions of the country during the 1980's and 1990's finally had been exhausted, and significant shortages of generating capacity were beginning to develop in almost every Region of the country.

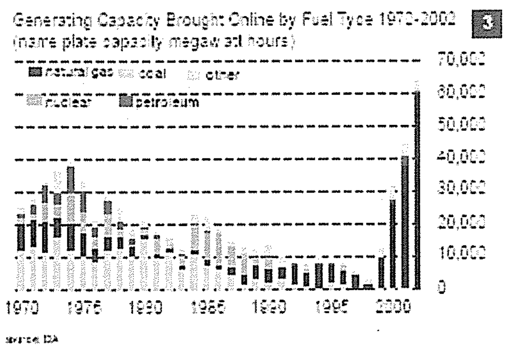
At that point, choices had to be made regarding the types of new generating capacity that would be built.

At the time, the utility industry, however, was in the midst of restructuring in most parts of the country. Utilities were no longer expected to build generation to serve native load – and in more than a few instances were prohibited from doing so. The integrated resource planning process that had existed in a number of States also was beginning to break down.

As a result, decisions regarding the type of new generation to build generally were made by private developers one project at a time. These developers could have chosen to undertake a diverse mix of projects – i.e., new coal-fired plants, natural gas, various forms of renewable energy, etc. In the end, however, virtually every developer decided to build plants burning a single fuel: natural gas.

The result was quite extraordinary – and extremely unfortunate: between 1999 and 2004 the power industry nationally undertook the most massive construction program in its history, building more than 215,000 MW of capacity. More than 98 % of this capacity nation-wide was gas-fired:

Figure 7
Types of Generation Added in U.S. Market



Source: EIA, Joint Economic Committee of U.S. Congress

The total cost of this new generation was in excess of $ 100 billion – one of the most expensive construction programs in history in any sector of the economy in any country in the world.

As an indication of the scale involved, enough total new generating capacity was added to serve *all* of the current electricity needs (i.e., 100 % of total current demand) in the three largest countries in Europe combined (i.e., Germany, Great Britain and France).

The effect of adding this huge amount of new gas-fired generation was to permanently transform the generating fleet in the U.S., from a mix of generating resources that over the past three decades was predominantly coal-fired, with most gas-fired units operating peaking units that typically generated electricity only a few hours a year to one in which more than 40 % of all generation in the U.S. is now gas-fired, with many gas-fired units expected to operate as baseload units with a high capacity factor:

Figure 8
Gas-Fired Generation Added Since 1999

Gas-Fired Generating Capacity Added Since 1999

Year	Additions	Total Gas-Fired Generation	% of Total US Capacity
1999	22,641 MW	201,979 MW	25.4%
2000	25,527 MW	227,506 MW	27.7%
2001	41,372 MW	268,892 MW	31.0%
2002	54,701 MW	323,593 MW	34.7%
2003*	60,488 MW	384,081 MW	39.0%
2004*	10,404 MW	394,485 MW	40.0%
Total Additions	215,133 MW		

* Includes plants currently under construction but excludes all planned additions that have not yet broken ground

While many of these new these gas-fired units are not yet fully-utilized, the majority were built to operate at a capacity factor between 80 and 95 %.

By forfeiting the opportunity to build new coal-fired units during this time frame, the decisions made by the developers who built these units effectively guaranteed that, at least until new coal-fired capacity or other alternative resources are built, virtually all of the incremental electricity demand in the U.S. can be met only by increased utilization of gas-fired units.

4. Brief respite during the 2001-2004 time frame.

The addition of this huge amount of new gas-fired capacity, however, did not immediately result in explosive growth in power sector consumption of natural gas; instead, the explosive growth is only now beginning to occur.

This delay in the explosive growth of power sector consumption of natural gas is due to the combined impact of three factors:

- The manufacturing recession that began in the spring of 2001 and subsequent extraordinarily mild weather in the fall of 2001 and winter of 2001-2002 which (as discussed earlier) had the effect of eliminating load growth during much of this period (and thus avoiding the increase in power sector consumption of natural gas that otherwise might have occurred in 2001 and early 2002);

- The efficiency gains that were achieved by adding a huge number of ultra-efficient new gas-fired in a short-period of time (which in effect provided a one time only "free lunch," which largely offset the increases in power sector consumption of natural gas that otherwise would have occurred in 2002 and 2003); and

- Extraordinarily mild weather in the eastern two-thirds of the U.S. during the summer of 2004, especially during July and August, which had the effect of reducing power sector consumption of natural gas by approximately 300 to 350 BCf, compared to the level of consumption that would have been likely to occur in a normal summer.

The efficiency effect, in particular, is often misunderstood.

In many respects, however, what occurred in the power industry in the period between 2001 and mid 2004 is analogous to what occurred in the airline industry after the introduction of more fuel efficient jet aircraft in the 1980's and 1990's.

Current generation aircraft, of course, such as a 757, an Airbus or the most efficient of the 737's, are considerably more fuel efficient than earlier generation aircraft, such as the 707.

When these aircraft were first introduced, therefore, airlines were able to reduce their use of older aircraft (and in some instances mothball them entirely) and cover many of their routes with aircraft that used considerably less fuel per passenger mile.

This resulted in two benefits:

- First, the average amount of fuel used per passenger mile declined significantly; and

- Second, for a period of time, on particular routes, depending upon the rate of traffic growth, total fuel consumption might actually decrease, even if the total number of passenger miles being flown on that route increased (i.e., in terms of total fuel consumption, there was a "free lunch').

The newer aircraft that were added, of course, always will be more fuel efficient than its predecessors; as a result, the average amount of fuel used per passenger mile on a particular route will be permanently reduced, compared to average fuel use during the 1970's.

After a period of years, however, many airlines added enough new "next generation" aircraft that on most routes they were flying *only* new, more fuel-efficient planes.

On these routes, therefore, in comparing fuel use from one year to the next, it no longer is possible to achieve a "free lunch" (i.e., a net reduction in *total* fuel consumed from one year to the next) – at least until a newer, next generation aircraft replaces the aircraft currently being used.

Instead, since all or almost all of the planes being flown are efficient, flying more passengers inevitably results in burning more total fuel – even though the new aircraft are more efficient than their predecessors.

Further, if airline traffic increases sufficiently, it may even become necessary to bring some of the older, less efficient planes out of mothballs (which is exactly what some airlines have announced they may be forced to do this summer), in which case the *average* amount of fuel used per passenger mile may also begin to increase.

In the power industry, at least in many Regions of the country, a very similar process began occurring in 2001 or 2002.

The new, ultra-efficient combined cycle units that typically have been added over the past 4 years are considerably more efficient than older, more conventional gas-fired power plants.

In every Region of the country in which these units have been added, once they are added, they are dispatched first. Further, enough new units were added in the 2001-2004 time frame so that, at least for a period of time, even though load was continuing to grow, utilization of older, less efficient units has been reduced. In some instances, older units were mothballed or dismantled; in most instances, however, they continued to operate – but at significantly lower capacity factors.

For a period of time, just as in the airline industry, this resulted in a "free lunch" – i.e., generators could serve more load using the same or even in some instances a reduced *total* amount of natural gas (i.e., the fuel saved by generating a large number of megawatt hours using more efficient plants more than offset any increase in fuel consumption that occurred as a result of an increase in the total number of megawatt hours generated from gas-fired plants).

Nationally, this in turn largely negated the huge increase in power sector consumption of natural gas that otherwise would have been likely to occur in 2002, 2003 and the first few months of 2004.

The Electric Power Institute (EPRI), for example, estimates that, by early 2004, the increase in power sector consumption of natural gas avoided by displacing the use of older, less efficient gas-fired generating units totaled at least 450 BCf/year.

For the most part, however, by mid-2004, in most parts of the country, the ability to keeping earning a new "free lunch" by continuing to add new combined cycle units every year was largely over.

The newer units are still operating. They still are dispatched first and they still produce electricity more efficiently than earlier generation equipment. As a result, there still is a tremendous efficiency gain by having built these units.

By mid-2004, however, during most hours of the year, in most parts of the country in which new units had been built, enough new, ultra-efficient units had been added to meet *the entire* load that was being served using gas-fired plants (i.e., it was just as if the airlines were using 757's).

Since that time, therefore, as demand for electricity has continued to grow and it has been necessary to continue increasing the number of megawatt hours generated by gas-fired plants, the only way to serve that load has been to operate gas-fired plants at higher capacity factors and/or for longer hours (i.e., the equivalent of flying 757's for more hours or flying a larger number of planes).

Even when additional new units have been added, they generally have exactly the same operating characteristics as the units that already were in operation by early 2004 or earlier.

As a result, while these units still use less natural gas to generate a megawatt hour of electricity than older, less efficient units, operating these units doesn't achieve any net reduction in *total* use of natural gas.

Further, in some instances, it has become necessary to start bringing back into service some of the older units that had been mothballed (or, alternatively, operate some of the older, less efficient units for much longer hours than was typical in 2002 or 2003).

This is likely to accelerate further potential increases in power sector consumption of natural gas.

<u>Likelihood of huge continuing year-over-year increases in power plant consumption of natural gas for much of the next decade</u>.

Now that the ability to earn a "free lunch" has ended in almost every Region of the country, as demand for electricity continues to grow, the effect is to increase rapidly power sector consumption of natural gas.

Remarkably little attention is being paid to the rate at which this increase is now occurring, even within the energy industry.

In its most recent Monthly Electricity Flash Report, however, EIA estimates that over the last 12 months generation from gas-fired plants has grown at a rate of 6.4 % -- almost 6 X the overall rate of growth of 1.1 %.

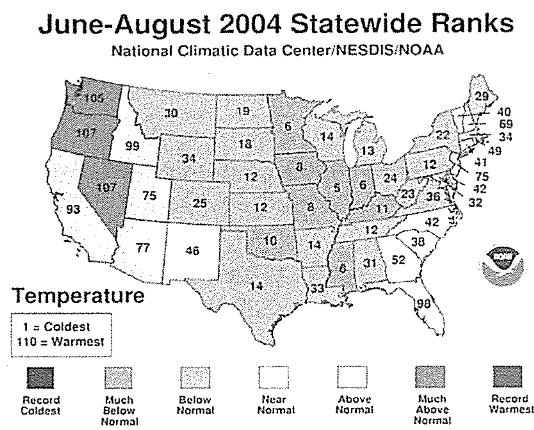
This in turn has resulted in an increase in power sector consumption of natural gas of just under 300 BCf.

Further, even this figure radically understates the amount of the increase that would have been likely to occur if weather conditions had been closer to historical norms – especially last summer.

As noted earlier, we estimate that if weather conditions last summer had matched historical norms, power sector consumption of natural gas would have increased by at least another 300 to 350 BCf. Further, the year-over-year increase in megawatt hours generated from gas-fired plants would have been well over 12 %.

The deviation from normal weather conditions last summer was not subtle, as the temperature map below helps to illustrate:

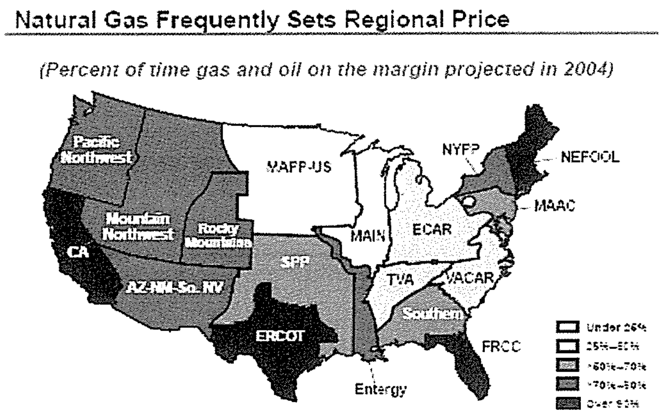
Figure 9
Departure from Normal Temperatures
Summer of 2004



It's only a matter of time, therefore – quite possibly this summer – before summer temperatures return to normal or hotter-than-normal conditions.

Once they do, large increases in power sector consumption of natural gas are inevitable, since in most Regions of the country there is no other source of generation available to serve incremental demand in the summer months when demand typically is at its peak:

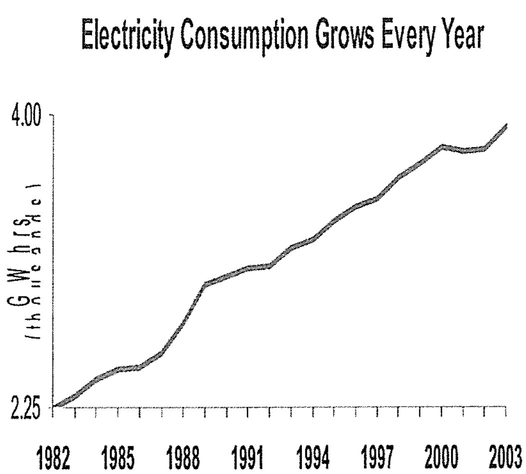
Figure 10
Percentage of Year Gas-Fired Generation =
Marginal Source of Supply



Source: CERA, August 2004

The problem we face, however, is not a short-term problem. Demand for electricity typically grows every year:

Figure 11
Long-Term Growth in Electricity Demand



In its most recent annual forecast, AEO 2005, EIA estimates that demand for electricity in the U.S. will grow by just under 25 % by 2015 and by 35.6 % by 2020.

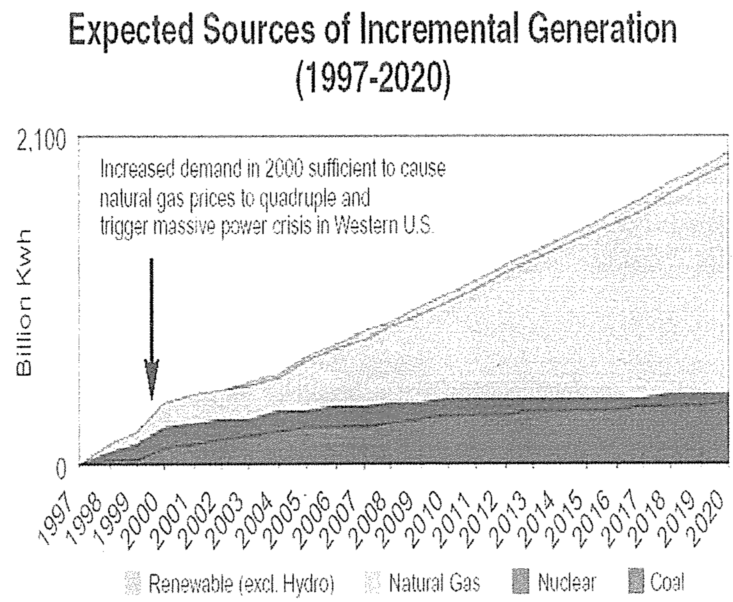
To meet this increased demand, EIA estimates that the amount of electricity produced from gas-fired plants must increase by 68 % by 2015 and 96.5 % (i.e., nearly double) by 2020.

Further, even these estimates are based upon a number of assumptions that may prove to be extremely optimistic (particularly regarding the potential ability to achieve huge increases in production from existing coal and nuclear plants without adding new generating units).

Absent aggressive efforts to add alternative resources, therefore, it is entirely possible that a far larger increase in the output of gas-fired units may be required in order to serve projected increases in demand.

The increase in the amount of electricity that will be required to be generated from gas-fired units is likely to be huge:

Figure 12



Even EIA, for example (using figures which we believe are too conservative) expects the amount of natural gas used to generate electricity, in a year with climatologically normal weather, to increase by 3.23 TCf by 2015 (i.e., 8.85 BCf/day) and by 4.32 TCf by 2020 (i.e., 11.85 BCf/day).

Absent aggressive implementation of the program outlined in Part I, we believe a more realistic estimate is on the order of 4.5 to 5.0 TCf by 2015 (i.e., 12.5 to 13.75 BCf/day) and 6.0 TCf by 2020 (i.e., approximately 16.5 BCf/day).

This is a staggering amount of energy. EIA's estimate of the *increase* in annual power sector consumption of natural gas that is likely to occur by 2020 is slightly greater, in BTU equivalent terms that the total amount of oil the U.S. currently imports from the Persian Gulf.

It also approximately equals any one of the following: *all* of the current production from the Gulf of Mexico (Near Shelf and Deepwater combined), *all* of the on-shore production along the Gulf Coast or *all* of the production from all of the Rocky Mountain States combined.

Achieving an *increase* in production would be a major challenge under any circumstance – indeed, in all likelihood would have been a major challenge even when the major fields in North America were in the prime.

As by now is well known, however, that is hardly the case.

<u>The assumptions that were made regarding the ability to expand gas supply in the North American market at the time commitments were made to build more than 200,000 MW of gas-fired plants have proven to be flatly incorrect</u>.

The nub of the crisis we face – and it is by any measure a potential crisis of severe magnitude – is that the assumptions that were made regarding the ability to expand gas supplies in the North American market at the time the decision was made to invest over $ 100 billion in the construction of new, gas-fired plants have proven to be flatly incorrect.

The most detailed analysis of the North American gas market prepared during the period when most of these projects were initiated is contained in two Reports: a 1999 Report prepared for the Secretary of Energy by the National Petroleum Council (NPC) in December of 1999 and EIA's Annual Energy Outlook for 2001. (Many of the same EIA staff members who are involved in the preparation of the Annual Energy Outlook also were involved in the preparation of the December 1999 NPC Study. However, since the Annual Energy Outlook for 2000 already was largely completed at the time the NPC Study was issued, the results of that Study were not fully reflected in EIA's Annual Forecasts until it issued its Annual Energy Outlook for 2001.)

Both Reports reached very optimistic conclusions regarding the ability to dramatically expand North American natural gas production without any significant increase in prices – conclusions which, quite frankly, with the benefit of hindsight, strain credulity.

In both instances, subsequent experience has demonstrated that the assessments provided in the Reports were far off the mark. Further, both the National Petroleum Council and EIA have subsequently published new assessments that, in effect, thoroughly repudiate the conclusions of these earlier Reports.

In the 4 to 5 years that intervened since these Reports were issued, however, more than $ 100 billion in gas-fired power plants has been built on the assumption that the conclusions in these Reports are valid.

Further, at least for the time being, these plants are the only source of generation available to meet incremental U.S. demand for electricity.

In effect, therefore, in an economy in which it is necessary to be able to increase electricity supplies in order to sustain economic growth, as a result of the decisions by power plant developers earlier in the decade to build almost exclusively gas-fired plants, the U.S. has now "bet the ranch" – in terms of its ability to sustain economic growth over the next decade -- on the assumption that it will be possible to provide the increased natural gas supplies necessary to operate these plants.

The fundamental problem that we must tackle at this juncture, therefore, is how best to regroup and develop an alternative strategy for meeting the needs of the U.S. economy now that it is clear that the increased natural gas supplies that the 1999 NPC Study and AEO 2001 led the industry to believe would be forthcoming are not going to be available.

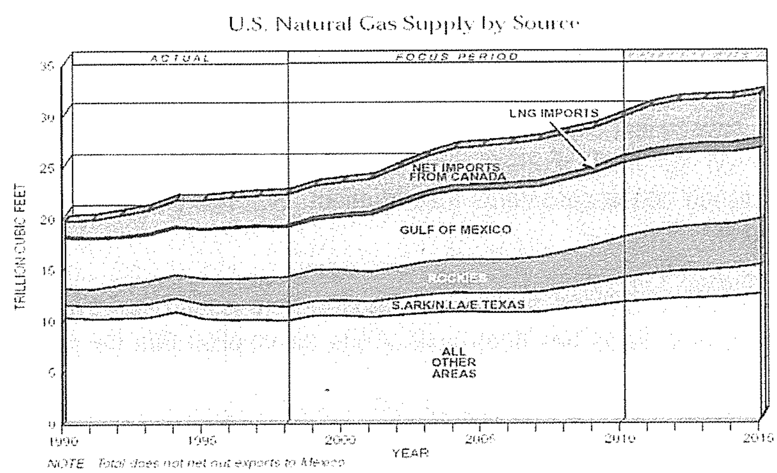
To understand the dimensions of the problem, it is worth reviewing the conclusions of the earlier studies briefly and comparing them to what the same entities are saying now – just a few years after they prepared their earlier reports.

<u>National Petroleum Council/EIA Position at the Time Decision Was Made to Build Gas Fired-Plants</u>

In some respects, the National Petroleum Council's reversal in its position is the most startling, since it occurred within such a short time frame: just 46 months (i.e., less that 4 years) separated its 1999 Study, which concluded that North American supplies could be expanded dramatically relatively quickly, and its September, 2003 Study (one of the most comprehensive evaluations ever undertaken of the North American natural gas market) which expressly refuted this conclusion.

Specifically, the December, 1999 Study concluded that by 2015, supplies available to the U.S. market could be increased from 1999 levels of 22.4 TCf (as a point of reference, nearly identical to EIA's estimate of the supplies available to the U.S. market in 2004) to 33.5 TCf (an increase of almost exactly 50 % in just over 15 years) without any significant increase price:

Figure 13
1999 National Petroleum Council Study



This Study was the most thorough examination of the North American natural gas markets available to many power plant developers at the time, lenders and investors at the time decisions were made to proceed forward with most of the gas-fired plants that come on line in the 2001-2004 time frame; it provided very little basis for concern regarding either the price or availability of the natural gas required to operate these plants.

The next EIA Annual forecast, however, AEO 2001, issued in December of 2000 (near the height of the 2000-2001 run-up in natural gas prices), was just as reassuring.

AEO projected that, between 2000 and 2020, U.S. production would increase by 10.29 TCf – from 18.18 TCf in 2000 to 28.47 TCf in 2020 (an increase of 56.6 %).

During this same period, total supplies available to the U.S. market (including imports from Canada) were projected to increase by an even larger amount (viz., 12.58 TCf) – from 21.69 TCf in 2000 to 34.27 TCf in 2020.

Further, during this same period, EIA projected that the wellhead price of natural gas in the U.S. actually would *decline* slightly.

AEO 2002, issued in December of 2001, offered a similar forecast.

It was not until EIA issued AEO 2003, therefore, in December of 2002 – just a little over 2 ½ years ago – that EIA began to retreat from its view that, on a long-term basis, supplies of natural gas from North American sources would be more than adequate to meet expected U.S. demand.

National Petroleum Council/EIA Repudiations of Earlier Positions

In the past 21 months, however, both the National Petroleum Council and EIA have thoroughly reassessed their positions. While neither organization has publicly repudiated its earlier Reports, their more recent Studies flatly contradict the conclusions just described.

The National Petroleum Council was the first to act. It's September, 2003 Study, available on the Council's website at www.npc.org, reflects the results of a far more comprehensive Study than its December, 1999 predecessor, conducted over a much longer time period, with far greater funding and better staffing.

It is the *only* in depth study of North American supply and demand conducted by any organization since the power plant construction program discussed earlier was initiated.

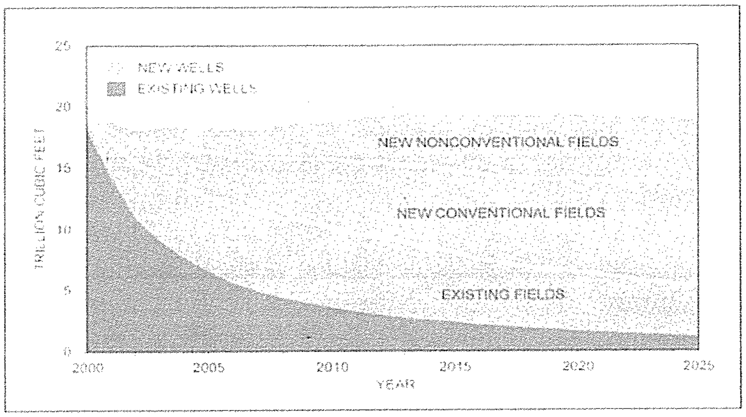
The conclusions it reaches are bleak.

Specifically, the Council concludes that, as a practical matter, **it is no longer realistic to expect that there can be a significant increase in natural gas supplies available from North American sources of supply south of the Arctic Circle at any time in the foreseeable future.**

This is a stark reversal of the conclusions of the National Petroleum Council's own previous study completed less than 4 years earlier.

The magnitude of the shift can be seen, for example, by comparing Figure 14 below, from the new National Petroleum Council Study, to Figure 13 on page 38 from the NPC's 1999 Study:

Figure 14
National Petroleum Council's 2003
Revised Estimates of U.S. Production



Lower-48 Production: Existing and Future Wells

Source: National Petroleum Council, September, 2003.

Based upon this reassessment, in its 2003 Study, the Council reduced its earlier, December 1999 estimate of expected U.S. supplies in 2010 by a staggering 6.0 Trillion Cubic Feet per year (or 16 BCf/day).

The effect of this revision is to create a hole in expected U.S. energy supplies, compared to its own prior estimate less than 4 years earlier that is equivalent, in BTU terms, to 1 ½ times the amount of oil the U.S. currently imports from the Middle East.

EIA's shift in position, however, while slower to come about, is just as extreme.

EIA's most recent forecast, AEO 2005, reduces its estimate of North American production in 2020 (excluding Alaska) by 10.95 TCf, from 33.97 TCf four years ago, at the time it issued AEO 2001 to 23.02 TCf – a reduction of a truly staggering 30 BCf/day – equal to about ½ of current U.S. gas supply in the space of just 4 years. (As noted earlier, the estimate EIA issued one year later in December, 2001, at the time it issued AEO 2002, was essentially identical to the estimate presented in AEO 2001.)

This precipitous fall-off in expected supplies from North American sources (excluding Alaska) reflects in part a lower starting point in 2005.

AEO 2001 assumed that both U.S. production and imports from Canada would *increase* significantly between 2000 and 2005:

Table 3
AEO 2001
Projected Changes in Supply Levels
2005 vs. 2000

Source	Estimated '00	Estimated "05	Difference
U.S. Production	18.18 TCf	20.34 TCf	+ 2.16 TCf
Canadian Imports	3.50 TCf	4.34 TCf	+ 0.84 TCf
Total	**21.68 TCf**	**24.68 TCf**	**+ 3.00 TCf**

Instead, both U.S. production and imports from Canada are now expected to *decline* over the same period:

Table 4
AEO 2005
Projected Changes in Supply Levels
2005 vs. 2000

Source	Actual '00	Estimated "05	Difference
U.S. Production	19.18 TCf	18.89 TCf	- 0.29 TCf
Canadian Imports	3.64 TCf	3.31 TCf	- 0.33 TCf
Total	**22.82 TCf**	**22.20 TCf**	**- 0.82 TCf**

Further, 2005 production is expected to fall 2.48 TCf *below* EIA's 2001 estimate of 2005 levels – a drop in expected supplies of 6.8 BCf/day compared to EIA's estimate just 4 years ago of the increase in supply levels that would be achieved by this year:

Table 5
Changes in 2005 Estimated Supply Levels
AEO 2005 vs. AEO 2001

Source	AEO 2001 Est.	AEO 2005 Est.	Difference
U.S. Production	20.34 TCf	18.89 TCf	- 1.45 TCf
Canadian Imports	4.34 TCf	3.31 TCf	- 1.03 TCf
Total	**24.68 TCf**	**22.20 TCf**	**- 2.48 TCf**

The fall-off in expected supply levels by 2020 is even more dramatic, both in terms of U.S. production (which EIA expects will increase only marginally from current levels) and Canadian imports (which EIA now estimates will decline, both compared to its 2001 estimate *and* relative to current levels):

Table 6
Changes in 2020 Estimated Supply Levels
AEO 2005 vs. AEO 2001

Source	AEO 2001 Est.	AEO 2005 Est.	Difference
U.S. Production	28.47 TCf	20.00 TCf	- 8.47 TCf
Canadian Imports	5.50 TCf	3.02 TCf	- 2.48 TCf
Total	**33.97 TCf**	**23.02 TCf**	**- 10.95 TCf**

Table 7
AEO 2005
Projected Changes in Supply Levels
2020 vs. 2005

Source	Estimated '05	Estimated ' 20	Difference
U.S. Production	18.89 TCf	20.00 TCf	+ 1.11 TCf
Canadian Imports	3.31 TCf	3.02 TCf	- 0.29 TCf
Total	**22.20 TCf**	**23.02 TCf**	**+ 0.82 TCf**

Notwithstanding these sharp drop-off in expected supply levels, however, EIA continues to project that the wellhead price of natural gas will decline modestly in real terms between 2005 (when EIA estimated prices would average $ 5.30/MMBTU, expressed in $ 2003) and 2020 (when prices are estimated to average $ 4.53/MMBTU, expressed in constant dollars). (At the time AEO 2005 was issued, EIA projected that natural gas prices would peak in 2005 and decline in subsequent years, reaching a low point of $ 3.64/MMBTU in 2010 and then slowly building back up to a projected peak level of $ 4.79/MMBTU in 2025, the last year covered by its forecast.)

What went wrong to cause both the National Petroleum Council and EIA to modify their forecasts for natural gas supply so dramatically and increase (at least to a degree) their price projections?

Fundamentally, three factors were at work:

i. Use of inaccurate assumptions regarding amount of new gas-fired capacity built.

First, neither EIA nor the National Petroleum Council assumed during this time frame that there would be anything like 200,000 MW of new gas-fired capacity built during the first 5 years of this decade. This is a key point. EIA, for example, assumed that only 99,000 MW of new combined cycle capacity would be built *over the entire decade*. The National Petroleum Council's assumptions were similar.

As remarkable as it may seem, during the period most of these plants were being built, no federal or state agency, and no one in private industry, ever examined on a comprehensive basis how much capacity was being built or attempted to estimate how much natural gas these plants consume. As a result, no one ever evaluated in a rigorous, systematic manner the potential impact of building these units on the price of natural gas. For the most part, this issue *still* has not been properly assessed to this day.

ii. Weak initial assessments of likely future production.

Second, with the benefit of hindsight, both the EIA and National Petroleum Council estimates of remaining natural gas reserves and likely future production rates were far off the mark. The 1999 National Petroleum Council Study in particular was far less rigorous than the Study released by the Council in September of 2003, which was the product of 18 months of effort, and reflected the results of a ground up assessment of likely future production rates in every major basin in the U.S. and Canada.

Clearly, with the benefit of hindsight, given the potential stakes for the U.S. economy, a far more comprehensive evaluation of the feasibility of expanding U.S. production of natural gas should have been undertaken before making commitments to build more than $ 100 billion of new gas-fired plants – and, in effect, betting the future health of the U.S. economy over much of the next decade on the ability to provide sufficient fuel for these plants.

The plain fact is, however, that it was not. Instead, only relatively superficial – and ultimately hopeless flawed – assessments were conducted before decisions were made to build these plants. These assessments (primarily by EIA and the National Petroleum Council), provided what proved to be a highly misleading pictures of the future natural gas production potential of U.S. fields.

iii. <u>No substitute for experience in the field</u>.

Even much better prepared Studies, however, might not have fully revealed what the oil and gas industry has since learned over the intervening 4 ½ years.

In the end, there is no substitute for experience on the ground in order to determine what is or isn't feasible.

By the late 1990's, many in the E&P industry recognized that the fields were aging, that the decline rate was accelerating, that new wells typically were smaller every year and that it was becoming necessary to drill more and more wells every year just to replace the production lost each year from existing wells.

But it is not clear that anyone in the industry fully anticipated the severity with which production has subsequently declined – which instead seems to have exceeded the worst fears of the most pessimistic industry observers just 48 to 60 months ago.

<u>The Bottom Falls Out</u>

The first glaring indication that natural gas production might begin to begin to rapidly decline arose during late 2000 and the first 9 months of 2001.

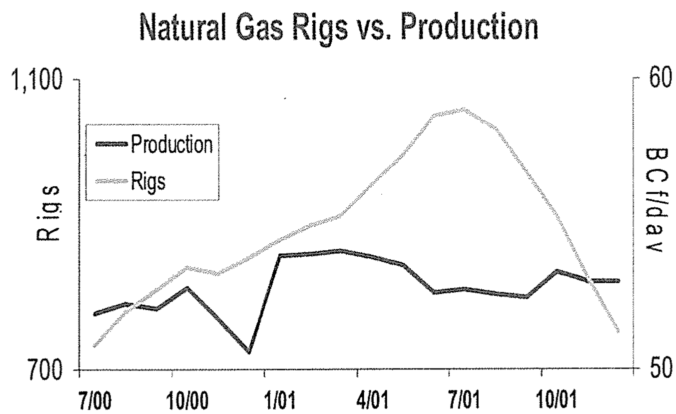
In late 2000 and early 2001, the first severe natural gas price spike occurred. Natural gas prices literally quadrupled over a period of just 3 or 4 months – peaking at $ 10.00/MMBTU in December of 2000 and January of 2001.

The E&P industry responded to this price spike exactly the way it might be expected to respond in a de-regulated market: with a massive ramp-up in drilling of new wells.

While it took time to plan and implement this new drilling program, within a period of about 9 months after the price spike reached its peak, drilling of new wells in the U.S. and Canada was at its highest level in years, with essentially every drilling rig in North America actively deployed in the field.

There was only one problem: even with every available rig fully deployed, there was virtually no increase in total U.S. production, as shown by the blue line in Figure 15 below (which shows no discernible upward slope during the period in which the number of rigs is reaching its peak):

Figure 15
2000-2001 Industry Experience



It is important to emphasize that this aren't just numbers on a graph; the increase from 700 rigs deployed in July of 2000 to almost 1,100 one year later correlates with increased expenditures by the E&P industry of at least $ 10 to 15 billion per year.

During the period between July of 2000 and July of 2001, however, even the expenditure of an additional $ 10 to 15 billion – deploying *all of the available rigs* in North America -- did not result in a significant increase in total U.S. production.

This doesn't mean that drilling new wells was a waste of time or money; to the contrary, the new wells produced large amounts natural gas.

Even with every available rig in North America actively deployed in the field, however, the total production achieved from new wells was just barely sufficient to offset the decline in production from existing wells.

On a *net* basis, therefore, there was no discernible increase in production – which is why the line is flat.

This in turn, however, is profoundly troubling. Most experts believe it would take several years in order to be able to fabricate a significant number of new drilling rigs. At least for the time being, therefore, if deploying every available rig isn't sufficient to increase production, it isn't clear what steps can be taken that have any realistic prospect for increasing total production from U.S. wells.

Subsequent experience

Unfortunately, the industry's experience has demonstrated that what occurred in 2000 and 2001 was not in any way a fluke.

Instead, to the contrary, ever since that time, it has been apparent that:

- The decline rate is continuing to accelerate every year;
- The size of a typical new well is continuing to fall; and
- The time required to deplete a typical new well is continuing to drop.

Further, if anything, the rate at which the size of new wells is declining appears to be accelerating.

As a result, even though the industry has been operating near full capacity all-year long this year (in terms of number of rigs deployed), every indication is that U.S. production is continuing to decline.

Based upon these factors, there does not appear to be a single E&P executive in North America who believes that this process can be reversed; instead, the best that anyone in the industry realistically expects is that it at most it *might* be possible to stabilize production at or near current levels for a limited time period. Whether even that is feasible, however, is not by any means certain.

Instead, given the intensive efforts that have been made during the past three to four years to maximize production from most existing fields in the both the U.S. and Canada, the limited number of prospects remaining in many of these fields, and the industry's apparent reluctance to devote substantial resources to exploration and development of new fields, there is a significant risk that, at some point during the next several years, production in many U.S. fields and/or in western Canada will begin to fall precipitously.

Despite the experience of the past several years, in which production has consistently fallen far below EIA's initial expectations, EIA has not factored this potential for further steep declines into its analysis.

The possibility that such declines could occur, however, is very real.

This increases further the urgency of developing an alternative strategy for meeting U.S. needs that can be deployed quickly and is under direct U.S. control, as suggested earlier in this paper.

Unless we begin implementing this strategy immediately, we may soon find that we are experiencing a serious natural gas supply deficit and have no ready means available to quickly expand available supplies.

This in turn potentially could leave the U.S. in a position in which it lacks the fuel and feedstock needed to grow the U.S. economy for a period that could extend for several years, potentially forcing many U.S. companies to permanently shift jobs overseas.

We can not afford to leave ourselves in this position – and there is no need to do so. Instead, strategies are available that can readily avoid this result, in a timely and cost effective manner.

Further, implementing these strategies can significantly *strengthen* the U.S. economy – creating large numbers of new U.S. jobs and avoiding entirely the need to increase our dependence upon imported fuels at a particularly inopportune time.

At a bare minimum, therefore, we need to more carefully examine the feasibility, costs, benefits and risks of competing alternatives before blindly pursuing a strategy that could seriously impair our country's ability to compete effectively in global markets.

- - Andy Weissman
Founder & Chairman
Energy Ventures Group, L.L.C.
3050 K Street, N.W.
Suite 205
Washington, D.C. 20007
202/944-4141
aweissman@energyvg.com

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